Brookhaven National Laboratory

MEMORANDUM

Date: 04/17/95

To: A. Etkin, S. Musolino

From: A.J. Stevens AJS

Subj.: Labyrinths in Proposed STAR Shielding Enclosure

I have evaluated the two access labyrinths proposed by the STAR collaboration[1] by use of the "universal" curves of Goebel.[2] The thickness of the STAR shield wall is 5 ft. of light concrete. Ignoring $1/R^2$ effects, this wall achieves an attenuation of 0.05[3]. Following both the procedure of Gollon[2] and standard design practice at the AGS, the labyrinth should achieve a similar attenuation.

The formula for the attenuation are:

$$H=\frac{1}{1+2.5\sqrt{d}+0.17d^{1.7}+0.79d^{3}} \text{ for the first leg and}$$

$$H=\frac{1}{1+2.8d(1.57)^{d+2}} \text{ for subsequent legs.}$$

where d is the length of the labyrinth leg divided by the square root of the area. The STAR design shows a 3 leg labyrinth on the east side of the shield wall and a 4 leg labyrinth on the west side. I have made the slightly simplifying assumption that the labyrinths are all 4 ft. × 10 ft. in area. The parameters from the design shown are given in the table below.

Table 1 Values of d for the Proposed Labyrinths and Total Attenuation

Quantity	East Labyrinth	West Labyrinth
Leg 1 d value	0.90	0.95
Leg 2 d value	1.34	1.29
Leg 3 d value	1.10	0.60
Leg 4 d value	—	0.47
Total Attenuation	0.001	0.0004

The labyrinths clearly have a large safety factor.

The blocks which form the first leg of each labyrinth have a significant lateral overlap with the shield wall to eliminate punch through. Both Asher and myself were satisfied that punch through is not a problem in the design proposed.

References/Footnotes

1. Memorandum from A.J. Stevens to S. Musolino on 04/14/95.

2. See P.J. Gollon, "Shielding of Multi-Leg Penetrations into the RHIC Collider," AD/RHIC/RD-76 (1994).

3. The attenuation length for light concrete is 50.2 cm

cc:

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Bill Christie
Dave Dayton
Jim Mills